Kehang Zhu

Harvard University
Email: kehang_zhu@g.harvard.edu
Personal Website: https://kehang-zhu.github.io/

EDUCATION

Ph.D., Harvard University *Sept. 2021 – Present*
- Physics
- Secondary field in Computer science and engineering

S.M., Harvard University *Sept. 2021 – May 2024*
- Major in Computer Science
- Thesis: Multi-agent interaction using Large language model

B.A., University of Science and Technology of China (USTC) *Sept. 2017 – July 2021*
- Major in Physics

AWARDS & HONORS

◇ *2024 Introduction to Technical AI Safety Fellowship, Harvard*
◇ *2024 APS March Meeting selected press coverage*
◇ *2023 Sky9 Innovation Fellowship*
◇ *2021 Purcell Fellowship, Harvard*
◇ *2020 Guo Moruo Scholarship (Highest honor for USTC undergrad students)*
◇ *2020 Yan Jici Scholarship (Highest honor for Physics department undergrad students)*
◇ *2019&2018 National Scholarship (top 1%)*

WORKING PAPER

- Manning, Benjamin S*., **Kehang Zhu***, and John J. Horton. "Automated Social Science: Language Models as Scientist and Subjects." arXiv preprint arXiv:2404.11794 (2024).
- Bae, Henry, Aghyad Deeb, Alex Fleury, and **Kehang Zhu***. "ComplexityNet: Increasing LLM Inference Efficiency by Learning Task Complexity." arXiv preprint arXiv:2312.11511 (2023, submitted).

PUBLICATION

- Benjamin Manning*, **Kehang Zhu***, John Horton. Automated Social Science: Using Large language Models to Identify Causal Relationships in Social Phenomena (2023 ICLC)
- **Kehang Zhu***, Benjamin Manning*, John Horton. Silica Scientist: A Tool for Automated Causal Hypothesis Generation and Simulated Experimental Validation (2023 CODE)
- Carolina Nobre*, **Kehang Zhu***, Eric Morth, Hanspeter Pfister, Johanna Beyer. Reading Between the Pixels: Investigating the Conceptual Hurdles to Visualization Literacy (2024 IEEE CHI)
- **Kehang Zhu,** Zhiping Yang et.al., Experimental sensing of a quantum atmosphere of a single spin, Quantum Frontier Volumn3, Article 1 (2020)

CONFERENCE PRESENTATIONS

- NBER SI 2024 Digital Economics and Artificial Intelligence workshop, Paper Presentation July 2024
- International Conference on Computational Social Science (IC2S2), UPenn, Oral June 2024
- AI, Cognition, and the Economy Spring 2024 Workshop, Microsoft Research May 2024
- AI and the Future of Work Conference ,Wharton, Paper Presentation (co-author) May 2024
- MeasureDev2024, World Bank, Paper Presentation May 2024
- Econometric Society Interdisciplinary Frontiers conference on Economics and AI+ML May 2024
- 2024 American Causal Inference Conference (ACIC), poster presentation May 2024
- CHI, Association of Computing Machinery, Paper Presentation (co-author) May 2024
- APS March Meeting, American Physical Society, Focused Talk Mar 2024
- Interactive Causal Learning Conference, Florida Atlantic University, Paper Presentation (co-author) Dec 2023
- Conference On Digital Experimentation (CODE), MIT, Paper Presentation (co-author) Nov 2023
- APS March Meeting, American Physical Society, Focused Talk Mar 2022

INVITED TALKS

- International Conference of the French Association of Experimental Economics (ASFEE), Grenoble Aug 2024
- AI Institute for Artificial Intelligence and Fundamental Interactions, MIT Feb 2024
- Human-computer Interaction, Harvard Nov 2023

RESEARCH

2023.5 – Now ***Large language model and Causal Inference, Econometrics*** MA, USA

Supervisor: Prof. John Horton (MIT Sloan Business School)
& Prof. David Parkes (Harvard EconCS group)

- Developed an end-to-end automatic pipeline that encompasses causal hypothesis generation, experimental design, simulation execution, econometric data collection, and hypothesis validation utilizing large language models (LLMs).
- Designed an algorithm for instantiating LLMs as human agents and their interaction
- Provided a sandbox to simulate and analyze various social scenarios – from wage bargaining to auction mechanics with the flexibility to vary agent properties across a nearly infinite parameter space

2023.3 – 2023.8 ***Human-computer Interaction and Visualization*** MA, USA

Supervisor: Prof. Hanspeter Pfister (Harvard CS department)
Prof. Carolina Nobre (CS department, University of Toronto)

- Used Qualtrics and D3.JS to build an empirical study that investigates the rationale behind mistakes in the visualization literacy assessment test.
- Applied eye-tracking technology to track the user's gaze when taking the visualization literacy assessment test.
- Built a mental model for conceptual barriers in interpreting data visualizations

2022.5 – 2023.5 ***Graph Neural Network and Machine Learning for material*** MA, USA

Supervisor: Prof. Boris Kozinsky (Harvard SEAS)

- Used Equivariant graph neural network (GNN) and Gaussian Process (GP) regression to study the conductance of Solid state battery electrolyte Li3PO4.
- Applied Density Functional Theory(DFT) package like VASP and Quantum Expresso to perform ab-initio calculation on Li3PO4 to build up dataset for machine learning
- Developed parallel computing in Harvard FAS Research Cluster(RC) to accelerate the computation.

2021 – 2022.5 ***Quantum Computing*** MA, USA

Supervisor: Prof. Amir Yacoby (Harvard Physics)

- Explored the signal processing method of Fourier imaging to break the diffraction limit of ensemble NV centers magnetometry
- Used a nanoscale magnetic field sensing platform to obtain the signal in Superconductor Josephson Junction.
- Used the random sparse sampling analysis method to reconstruct the 2D periodic magnetic field distribution
- Developed Diffusive Monte Carlo Algorithm to simulate the non-equilibrium dynamics of dipolar spin ice (DSI)

2020 – 2021 **Computational Quantum material and Quantum information** MA, USA

Supervisor: Prof. Frank Wilczek (MIT theoretical physics center)

- Developed Quantum Monte Carlo to carry out the simulation of the emergent photon and spinon behavior in quantum spin ice (QSI)
- Developed the quantum worm algorithm (WA) to study minimal model--XXZ model on the pyrochlore lattice
- Measured QSI's thermodynamics and added additional terms to tune the speed of light and emergent charge and see how physical observables change by tuning these parameters

2018 – 2020 ***Quantum computing*** Hefei, China

Supervisor: Prof. Jiangfeng Du & Prof. Rong Xing (USTC)

- Built up an Nitrogen-vacancy (NV) center quantum Sensing platform using laser and microwave
- Designed a CNOT-like gate to perform non-demolition measurement of nuclear spin's quantum state
- Searched for Spin-Dependent Interaction Mediated by Axion-Like Particles using NV center

TEACHING

- 2023-2024, Leading TA, Harvard Physics 262/ Applied Physics 284 – Statistical Mechanics
- 2023, Harvard Physics 1-A – Introduction to Physics

REVIEW

- ICML
- ACM CHI / Vis / Pacific Vis/ EuroVis/
- International Conference on Computational Social Science (IC2S2) / ACM Collective Intelligence
- International Conference on Neural Information Processing (ICONIP)

SKILLS

- Analysis: Python/ R/ C++
- Full-stack: REACT, Flask, FastAPI
- Database: MySQL/ SQLite/ Vector Database (Pinecone)
- Visualization: D3.JS, R
- Cloud computing: Azure, google cloud

- Machine learning: Pytorch,Tensorflow, JAX, NLP.
- User Study: Qualtrics
- Finance (HKS API141)

ACTIVITY INVOLVEMENT

Harvard GSAS Entrepreneurship Community, *a Harvard student organization aiming to promote innovation and Entrepreneurship among graduate students.* MA, USA
President *2021.12 – 2022.12*

Harvard GSAS Web3 Demo Day, *a Demo show for innovations on Web3 and Metaverse technologies.* MA, USA
Co-organizer *2022.11*